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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/942,962	08/31/2001	Takaaki Sasaki	TAI 131	7694

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EXAMINER

ZARNEKE, DAVID A

ART UNIT	PAPER NUMBER
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2827

DATE MAILED: 05/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/942,962

Applicant(s)

SASAKI, TAKAAKI

Examiner

David A. Zarneke

Art Unit

2827

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on 29 January 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-13, 24 and 26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13, 24 and 26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 August 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☒ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Response to Arguments*

Applicant's arguments, see page 9, 2<sup>nd</sup> to last paragraph plus, filed 1-29-03, with respect to the rejection(s) of claim(s) 1, under 35 USC 102 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of the new references relied upon in the rejection below.

Applicant's arguments, see page 11, 2<sup>nd</sup> to last paragraph plus, filed 1-29-03, with respect to the rejection(s) of claim(s) 24, under 35 USC 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of the new references relied upon in the rejection below.

Applicant's arguments with respect to claim 26 have been considered but are moot in view of the new ground(s) of rejection.

Applicant traverses the examiner's holding of official notice stating that the claimed combination of a Ni layer that prevents inter-diffusion of Cu into the wiring pattern and AU in the 2<sup>nd</sup> electrode.

The examiner cites Lau, Flip Chip Technologies, 1996, McGraw-Hill, pp. 27-31, Figures 1.27, 1.29b and highlighted sections as proof that this combination is notoriously well-known in the art. In this Figure a Cu wiring is covered with a Ni layer

followed by an Au layer. The Au layer exposing an interconnection pad where solder can be deposited.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-4, 7, 8, 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamashita et al., US Patent 5,726,493, in view of Farnworth et al., US Patent 6,451,624.

Yamashita teaches a semiconductor package comprising:

a printed circuit base (11) having a prescribed electrode pattern on each side thereof and electrically connected together by through holes (15);

a semiconductor chip (12) placed upon the upper surface of the PCB (11) and electrically connected to the upper electrode pattern using bond wires (14);

a sealing resin (16), which seals the semiconductor chip (12) and the upper electrode pattern;

a plurality of electrode members (22) formed in the sealing resin (16), one end of which is electrically connected to the through holes (23) of the upper electrode pattern (15); and

a plurality of pads (13) formed on the lower electrode pattern for solder ball (13) placement.

Yamashita fails to teach forming the electrode members such that they are level with the top of the sealing resin.

Farnworth teaches a method of making a stackable package wherein a die (14) is attached to a substrate (22) and encapsulated in a resin (18); forming conductive vias (38 & 40) in the resin that contact the substrate (22); *at least partially filling the vias with conductive material* (4, 46+), Figures 2C and 2D showing the conductive material as being formed level with the top of the resin (18).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the invention of Farnworth in the invention of Yamashita because Farnworth teaches the equivalence of partially filling the via with filling the via such that it is level with the top of the resin.

The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution. Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In re Mostovych 144 USPQ 38 (CCPA 1964); In re Leshin 125 USPQ 416 (CCPA 1960); Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

Regarding claim 2, Yamashita teaches a plurality of solder balls (13) formed on the lower surface (11b) of the PCB (11) (Figure 1) and alternatively, a plurality of solder balls (13) formed on the end of the electrode members (17) (Figure 11).

With respect to claim 3, Yamashita teaches attaching a second PCB (11) to the surface of the sealing resin (16), the second PCB (11) having an electrode on each side thereof, the lower electrode pattern electrically connected to the electrode members, and the upper electrode pattern electrically connected to the lower electrode pattern by through holes (15), wherein a 2<sup>nd</sup> electrode is formed in the second PCB at the surface of the sealing resin where the electrode members are exposed (Figure 11).

As to claim 4, Yamashita teaches solder balls (13) connecting the electrode members (17) of the first PCB to the lower electrode pattern of the 2<sup>nd</sup> PCB (Figure 11).

Regarding claim 7, Yamashita teaches the 1<sup>st</sup> and 2<sup>nd</sup> electrodes to be disposed at different positions in horizontal directions (Figure 11).

With respect to claim 8, Yamashita teaches a 2<sup>nd</sup> semiconductor chip (12) placed upon the upper surface of the 2<sup>nd</sup> PCB possibly having a different function (Figure 11).

As to claims 11, Yamashita teaches mounting the package upon a motherboard (18) (Figure 2).

Regarding claim 12, Yamashita teaches stacking the packages in various ways and using various techniques (Figures 11-16).

Claims 5, 6, 9, 10 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamashita et al., US Patent 5,726,493, as applied to claim 1 above, and further in view of Aiba et al., US Patent 6,348,728.

Regarding claims 5 and 6, Aiba teaches semiconductor device comprising a redistribution layer formed upon the surface of a sealing resin covering a chip, wherein a metal pattern (18a) is coated over a sealing resin (28), an insulating resin covers the

metal pattern and lands (18b) [3<sup>rd</sup> electrode], which are electrically connected to the metal pattern (18a), are exposed there through (Figure 5B & 7, 51+).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the redistribution layer of Aiba in the invention of Yamashita because redistribution layers are conventionally known in the art and the use of conventional materials to perform there known functions in a conventional process is obvious. In re Raner 134 USPQ 343 (CCPA 1962). Redistribution layers are commonly known in the art and are used to increase the mounting area of a semiconductor device to enable mounting to proceed using conventional techniques (Aiba, 1,66+).

With respect to claim 9, Yamashita and Aiba combined teach the 1<sup>st</sup> and 3<sup>rd</sup> electrode to be disposed at different positions in horizontal directions.

As to claim 10, Yamashita teaches the electrically connecting of more than 1 chip onto the upper surface of the 2<sup>nd</sup> printed circuit base, possibly having a different function than the other chips (Figure 16).

Regarding claim 13, Aiba teaches the use of memory elements in amongst the chips to be packaged (Figure 1A-1D).

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamashita et al., US Patent 5,726,493, in view of King et al., US Patent 6,429,528.

Yamashita, relied upon as recited above, fails to teach a wiring pattern being added to the top of the sealing resin.

King (Figures) teaches the use of redistribution layers wherein there are a plurality of wiring layers that are arranged in an alternating pattern of 1 wiring layer being closer to the center of the chip than the other.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the wiring pattern of king in the invention of Yamashita because King teaches that a wiring pattern arranged in this manner allows for close proximity positioning of multiple electrodes and also for avoiding electrical shorts amongst the pair sets (abstract).

As to claim 25, King teaches a plurality of 1<sup>st</sup> and 2<sup>nd</sup> wirings that are alternately arranged (Figures).

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamashita et al., US Patent 5,726,493, in view of Aiba et al., US Patent 6,348,728, and Lau, Flip Chip Technologies, 1996, McGraw-Hill, pp. 27-31, Figures 1.27, 1.29b.

Yamashita, relied upon as taught in the rejection of claims 24 and 25, fails to teach a wiring pattern formed on the sealing resin and electrically connected being made of Cu and an electrode formed on the wiring pattern and being made of a Ni layer and a Au layer.

Aiba teaches forming a wiring pattern (18 and 34) upon the surface of the sealing resin having Cu (7, 58+) posts (32) and a solder ball electrode (36) formed thereon (Figure 7B).

Regarding the use of a Ni layer under an Au bump, the examiner takes "official notice" since the claimed subject matter is notoriously well known in the art (MPEP

2144.03). The formation of a Ni layer under an Au bump is commonly used in the art to prevent interdiffusion of a Cu wiring and an Au bump as taught by Lau.

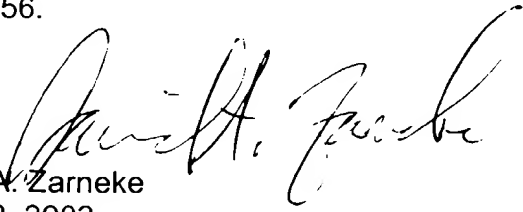
Lau teaches in these Figures a Cu wiring is covered with a Ni layer followed by an Au layer. The Au layer exposing an interconnection pad where solder can be deposited.

### **Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David A. Zarneke whose telephone number is (703)-305-3926. The examiner can normally be reached on M-F 10AM-6PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David L. Talbott can be reached on (703)-305-9883. The fax phone numbers for the organization where this application or proceeding is assigned are (703)-308-7722 for regular communications and (703)-308-7721 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)-308-0956.

  
David A. Zarneke  
April 22, 2003